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28 October 2011

Dear Murray

Royal Randwick Racecourse
Spectator Precinct - DGR Report- 0002Spectator Precinct Light Spill Issue 2

As part of the Spectator Precinct 75w planning process Arup have been asked to review the current architectural documents listed below and advise the impacts to the recommendations made within the above DGR report.

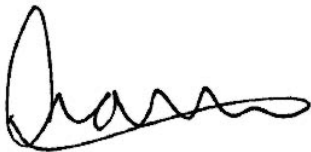
The buildings form essentially remains the same although it has shortened a little.

| Title | Number | Rev |
|----------------------------------|--------|-----|
| Existing Roof Plan | DA-05 | B |
| Proposed Roof Plan | DA-06 | B |
| Proposed Site Plan | DA-07 | B |
| Proposed Site Elevations | DA-08 | B |
| Previous DOP Scheme Overlay | DA-09 | B |
| Grandstand Basement 1 | DA-10 | B |
| Grandstand Ground | DA-11 | B |
| Grandstand Level 1 | DA-12 | B |
| Grandstand Level 2 | DA-13 | B |
| Grandstand Level 3 | DA-14 | B |
| Grandstand Level 4 | DA-15 | B |
| Grandstand Level 5 | DA-16 | B |
| Grandstand Level 6 | DA-17 | B |
| Grandstand Level Plant | DA-18 | B |
| Grandstand Level Roof | DA-19 | B |
| QEII Section A-A (Existing) | DA-20 | B |
| QEII Section A-A (Demolition) | DA-21 | B |
| QEII Section A-A (Proposed) | DA-22 | B |
| Paddock Sect B-B & Link Sect C-C | DA-23 | B |
| Elevation NW-SE | DA-24 | B |
| Elevation SW-NE | DA-25 | B |

| | | |
|-------------------------|-------|---|
| Parade Ring Ground | DA-30 | B |
| Parade Ring Level 1 | DA-31 | B |
| Section A-A & B-B | DA-32 | B |
| Section C-C & D-D & E-E | DA-33 | B |
| View Analysis – V2 | DA-52 | B |
| View Analysis – V3 | DA-53 | B |
| View Analysis – V4 | DA-54 | B |
| View Analysis – V6 | DA-56 | B |
| View Analysis – V7 | DA-57 | B |
| View Analysis – V8 | DA-58 | B |
| Cut & Fill Plan | DA-60 | B |

Having reviewed the above documents we confirm that the new building configuration does not alter the recommendations made within the original DGR report and no amendments are required to the report.

Yours sincerely



Tim Carr
Lighting Designer

Australian Jockey Club

Spectator Precinct

**Environmental and Residential
Amenity, Light Spill**

220759-00

ISSUE 2 | September 2010

Arup
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

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This report takes into account the particular
instructions and requirements of our client.

It is not intended for and should not be relied
upon by any third party and no responsibility is
undertaken to any third party.

Job number 220759-00

ARUP

| | | | | | |
|---|----------|--|---|---|---|
| Job title | | Spectator Precinct | | Job number | |
| | | | | 220759-00 | |
| Document title | | Environmental and Residential Amenity, Light Spill | | File reference | |
| | | | | | |
| Document ref | | 220759-00 | | | |
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| Draft 1 | 27/08/10 | Description | First draft | | |
| | | | Prepared by | Checked by | Approved by |
| | | Name | TH | TC | NH |
| | | Signature | | | |
| Issue | 20/09/10 | Filename | 0002Light Spill_Issue.docx | | |
| | | Description | Issue | | |
| | | | Prepared by | Checked by | Approved by |
| | | Name | TH | TC | NH |
| | | Signature | | | |
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| | | Description | Issue 2 | | |
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| | | Signature |  |  |  |
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Executive Summary

This report has been produced in response to the Director Generals Part 3A Planning requirements MP 10-0097 for the redevelopment of the Spectator Precinct located on the Western side of the Royal Randwick Racecourse property.

It addresses the issues associated with the Director Generals requirement 6, “Environmental and Residential Amenity”, Light Spill. In particular it addresses the impact on the proposed 66A Doncaster Avenue.

It has been produced in response to the Appendix B item 20 requirement for a Lighting Report to address the impact of lighting and light spill on surrounding residential developments. It encompasses the requirement to design the lighting for the proposed Spectator Precinct including QEII, Paddock and Owners and Trainers Pavilion in line with AS4282 Control of the Obtrusive effects of Outdoor Lighting. This report aims to focus on the different requirements of the above standard with regards to the following principles:

- Light trespass (Light pollution)
- Luminous intensity (Luminaire brightness)
- Threshold increment

The analysis undertaken shows that the new Spectator Precinct lighting can meet the requirements of AS4282 and those of the Director General’s requirements.

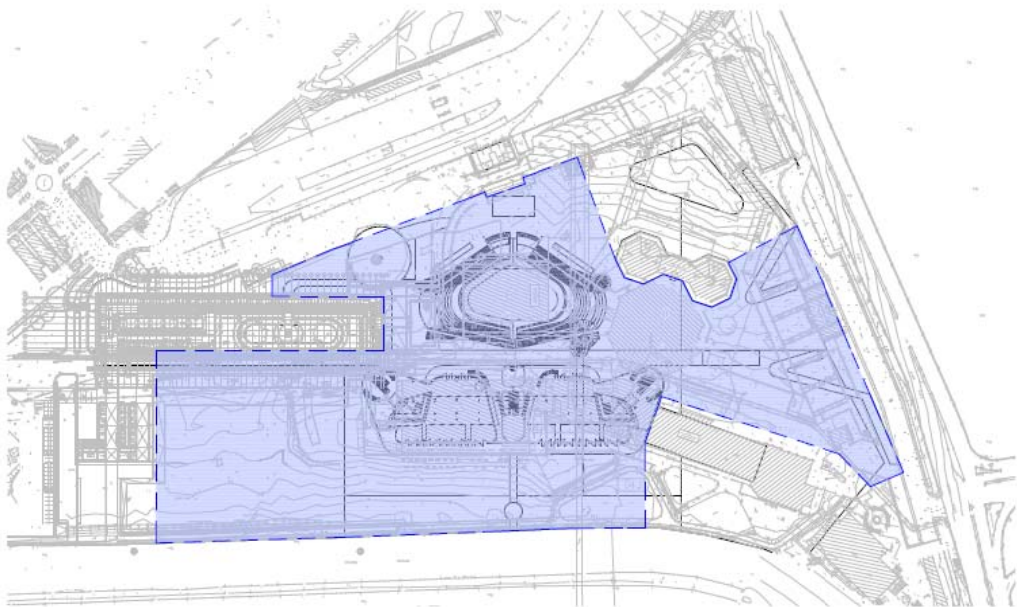
In conclusion this Lighting and Light Sspill report has analysed the lighting options for the site and specifically addresses the impact on the 66A Doncaster Ave property. It makes the following recommendations in terms of Light Trespass, Luminous Intensity and Threshold increment to achieve the requirements of AS 4282.

| Technical Parameter | Maximum Permissible Value | Calculated value | Compliant |
|---------------------|---|------------------|-----------|
| Light Tresspass | 10 lux | 3.18 lux | √ |
| Luminous Intensity | 1000 cd | 315 cd | √ |
| Threshold Increment | Luminaires have minimum viewing angles from Alison Rd and Doncaster Avenue and therefore do not impact upon them. | | √ |

1 Introduction

The redevelopment of the existing Spectator Precinct will see the existing QE II Grandstand refurbished and a new Paddock Grandstand and Owners and Trainers Pavilion constructed including basement levels, a new parade ring and spectator amenities such as kiosks and landscaped areas.

The site overlay below shows the spectator precincts location on site near the intersection of Alison road and Doncaster Avenue.



The Spectator Precinct is being redeveloped and upgraded and this report addresses the Light Spill impacts associated specifically within the new works and it’s impact on the neighbouring developments.

The existing precinct currently incorporates perimeter lighting poles along it’s perimeter. This report does not address the operation and performance of these existing fittings however it does demonstrate that the new provisions meet the requirements of AS 4282.

2 Control of Obtrusive Light

2.1 AS4282 Control of the Obtrusive Effects of Outdoor Lighting

The three main technical parameters covered within AS4282 Control of the Obtrusive Effects of Outdoor Lighting are as follows:

2.1.1 Light Trespass

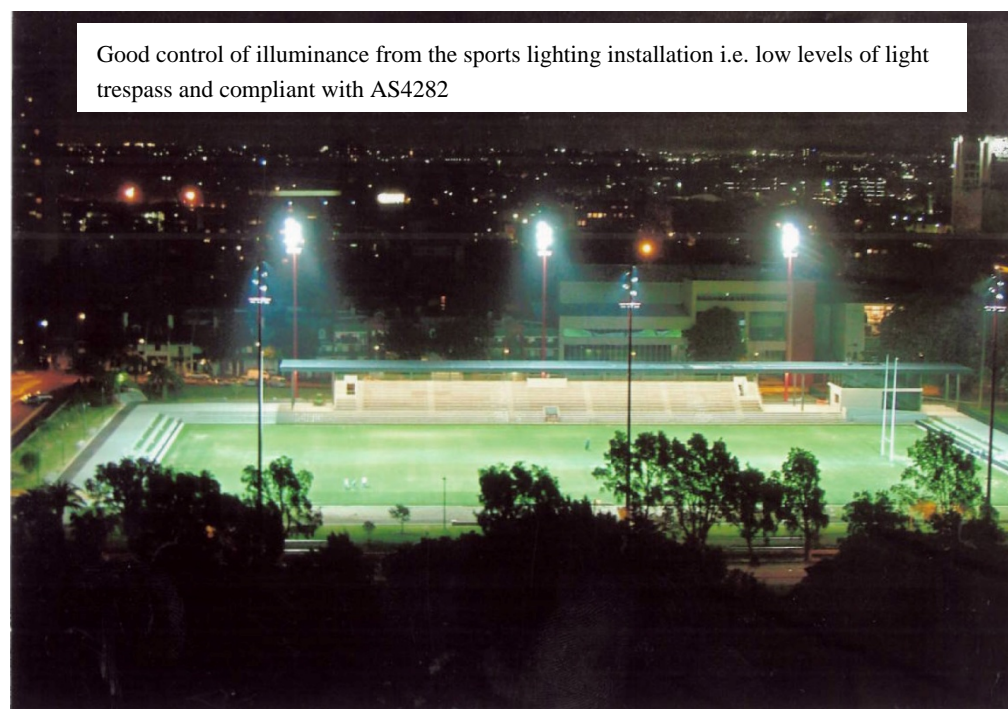
Light trespass is a term that describes an amount of light falling onto a vertical surface (measured in illuminance or lux) outside of the boundary of the lit property. This can be thought of as the theoretical location of a window. Light trespass can be reduced by selecting the appropriate optical control within a luminaire and applying care when aiming fittings. It should be noted that within the Australian Standard potential light trespass is to be controlled into residential properties only, and that the level of light trespass allowed is dependent on the time of day.

Typically a curfew time is agreed with the local authority, 11.00pm is the standard suggestion as per the Australian standard and it is intended to adopt this for the Spectator Precinct. After this curfew the level of permissible light trespass will be decreased. This criteria allows sporting and other large venues to operate when located adjacent to residential properties.

Furthermore the level of acceptable light trespass is also dependant on the district brightness of the surrounding area. As such a lighting installation within an urban environment will have a higher permissible level of light trespass than the same installation within a rural setting.

Section 3.1 indentifies the maximum permissible level of light trespass proposed for this development.

Example of a sporting installation pre-curfew with minimal light trespass



2.1.2 Luminous intensity

The visible luminous intensity or brightness of a luminaire will be controlled when the fitting can be observed from a residential property. While luminaire with a high apparent brightness can also cause light trespass, this 'luminous intensity' principle is related primarily to glare, and the subjective annoyance an overly bright luminaire can cause when visible from a property.

The luminous intensity of a luminaire is measured in candelas (cd)

The level of permissible luminous intensity is governed by the operating hours or curfew as above, and the area of site the fitting is illuminating. For example luminaires lighting a large car park would have a higher permissible brightness than those lighting a pathway.

As with light trespass the maximum luminous intensity of a luminaire is also governed by the brightness of the surrounding properties or developments.

Section 3.1 indentifies the maximum permissible level of luminous intensity proposed for this development

2.1.3 Threshold Increment

This principle aims at controlling the potential glare caused by an exterior lighting installation on road users. It is based upon the perceived brightness of the surrounding environment when viewed by a motorist and the potential contrast caused by a bright luminaire or lighting installation.

Threshold increment can be controlled with the aiming of luminaires, and the selection of luminaires. As with the previous technical parameters the maximum level of permissible threshold increment is dependent on the surrounding brightness of the environment.

Section 3.1 indentifies the maximum permissible level for threshold increment proposed for this development

2.2 Lighting Prediction

The above parameters are calculated via computer modelling based on the proposed lighting solutions. This will be undertaken during the detailed design phase of the project, and summarised by the lighting designer to ensure that the requirements of the Australian Standard are adhered to.

2.3 Assumed site operations and lighting curfew

Three modes of operation have been assumed within the spectator precinct. These are:

- Race day
- Event day e.g. music festival
- After hours

It has been assumed that the main activity during a race day and event day will come to a close prior to 11pm as per the standard lighting curfew. After this time it is proposed that the lighting within the spectator precinct will revert to an afterhours setting.

This report analyses the post curfew condition as it is this that it is required to review under AS 4282.

Based on the architectural information the lighting concept is to primarily illuminate the main arterial pedestrian circulation areas. Lighting will also be provided in and around the Spectator Precinct for the differing buildings including the Stands and Parade Ring and this will be provided for day to day operation and be configured to respect the requirements of AS 4282.

The strategy is detailed further within the Brightness Hierarchy diagram in Section 4

3 Desk Top Assessment of Impact on 66a Doncaster Ave

An initial desk top assessment has been undertaken on 66a Doncaster Avenue. The Australian Standards refer to the effect on residential properties only. Therefore as the closest area of the development to residencies, the perimeter condition has been investigated at the entry and car park adjacent to Doncaster Avenue. This is deemed to be the worst case scenario i.e. the one most likely to have an adverse effect on Doncaster Avenue.

3.1 Lighting to Doncaster Avenue

The Spectator Precinct is adjacent to the 66a Doncaster Avenue site and the following recommendations are made regarding light trespass, luminous intensity and threshold increment. The intention is that the following factors be used during the design of the lighting installation, and as such these will form the brief for all exterior lighting which may affect nearby residential properties. The following recommendations are based on AS4282 Table 2.1 page 17:

| | |
|---|-----------------|
| Brightness of surrounding area | Light Surrounds |
| Light trespass max illuminance (curfew hours) | 10 lux |
| Max luminous intensity (curfew hours) | 1000 cd |
| Maximum threshold increment | 20% |

3.2 Design Assumptions



Arup has identified the following design targets for the precinct based on the following Standard:

AS/NZS 1158.3.1:2005 Lighting for roads and public spaces Part 3.1: Pedestrian are (Category P) lighting – Performance and design requirements

Table 2.2 Lighting Categories for Pathways

Table 2.9 Values of Light Technical Parameters and Permissible Luminaire Types for Outdoor Car Parks

The Standard identifies the following:

3.2.1 Main footpaths

Main footpaths are proposed to be lit to Category P2 as per the above standard

| Type of area | Parking spaces, aisles and circulation |
|---|--|
| Night time vehicle/pedestrian movements | High |
| Risk of Crime | Medium |
| Average illuminance at ground level | 3.5lux |
| Minimum point illuminance | 0.7lux |
| Minimum point vertical illuminance | 0.7 lux |

3.2.2 Connection circulation routes

Main footpaths are proposed to be lit to Category P3 as per the above standard

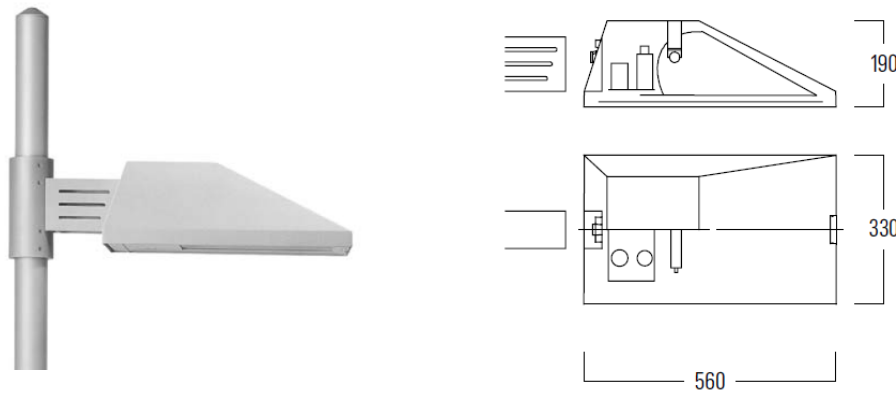
| Type of area | Parking spaces, aisles and circulation |
|---|--|
| Night time vehicle/pedestrian movements | Medium |
| Risk of Crime | Low |
| Average illuminance at ground level | 1.75lux |
| Minimum point illuminance | 0.3lux |
| Minimum point vertical illuminance | N/A |

4 Brightness Hierarchy



4.1 Assumed Luminaire Type

To complete the calculation a typical luminaire type has been assumed to deliver the above design targets. The typical luminaire used is as follows:



We-Ef PFL 240

1x70W CDM-T Ceramic Metal Halide

Forward throw luminaire mounted on 7m pole

This luminaire has been selected based on its appropriate optical performance and level of quality to achieve the above targets. It is yet to be approved by the architect/design team and as such is not intended to be the final specification. It is to be used for comparison purposes only.

4.2 Light Trespass Calculation Model

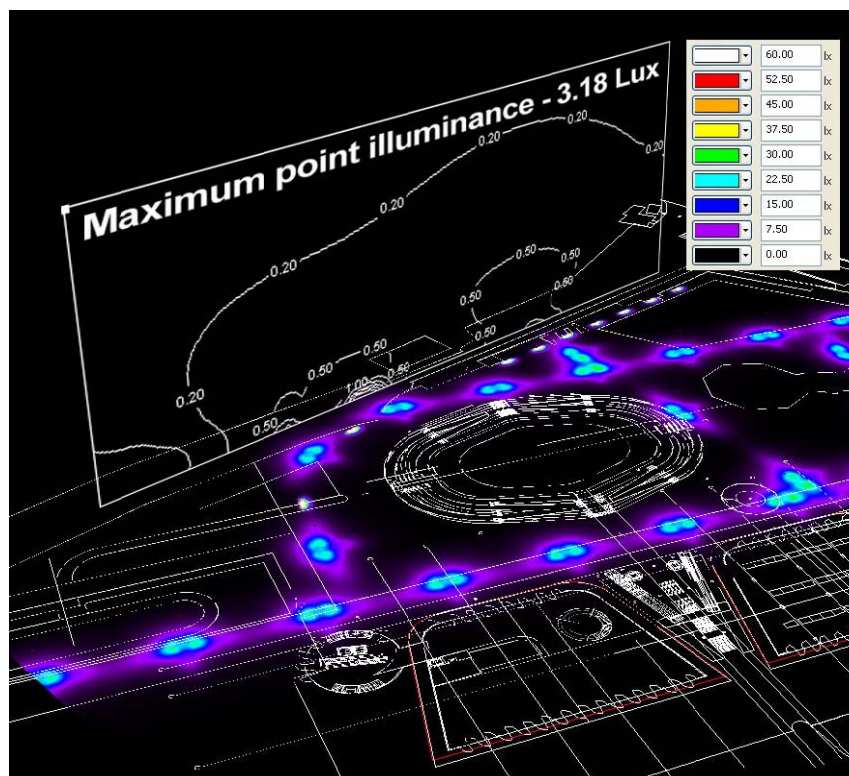
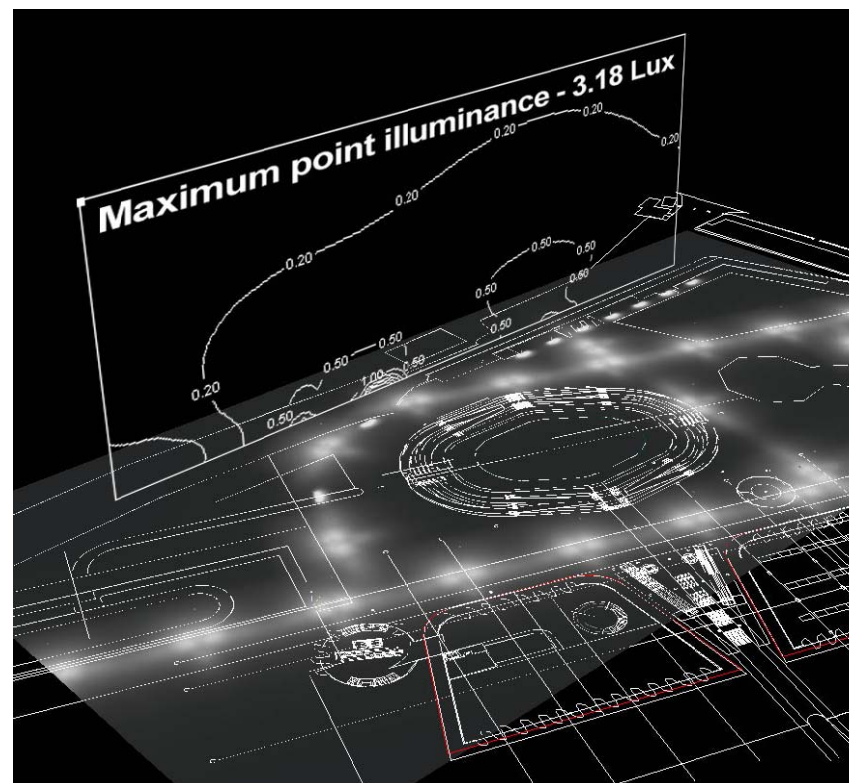
A calculation model has been developed to investigate any potential light trespass onto the proposed new houses along 66a Doncaster Avenue site. Below is a screen grab from the computer calculation model.

The green areas show the theoretical calculation surfaces used to measure illuminance



4.3 Calculation results

The below images show the results of the calculation model and the maximum point illuminance

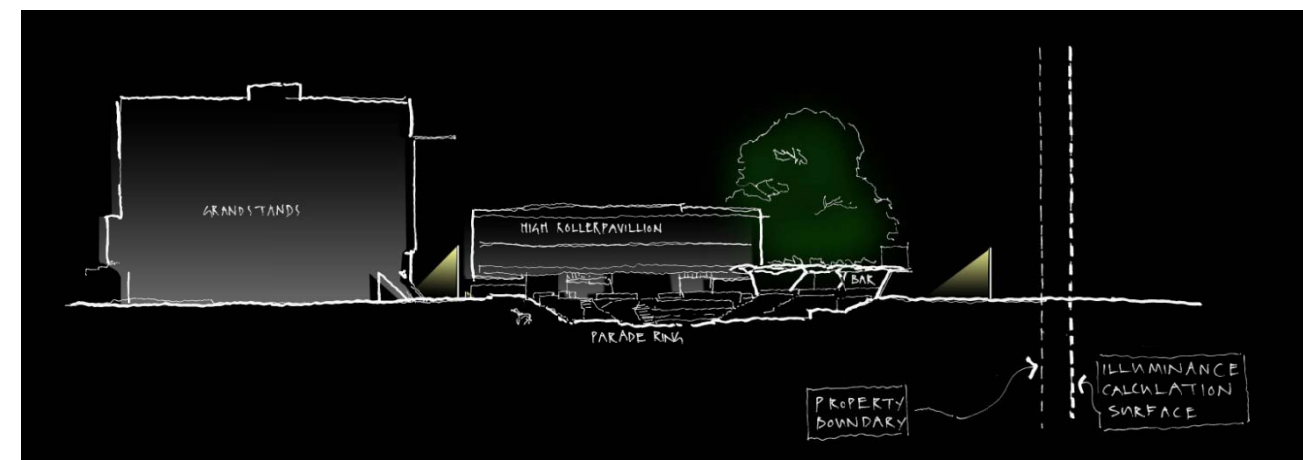


The above images show that the maximum level of illuminance upon the site boundary of Doncaster Avenue is 3.18 lux. This is well below the maximum permissible value of 10 lux as per AS4282.

This analysis shows compliance with AS4282.

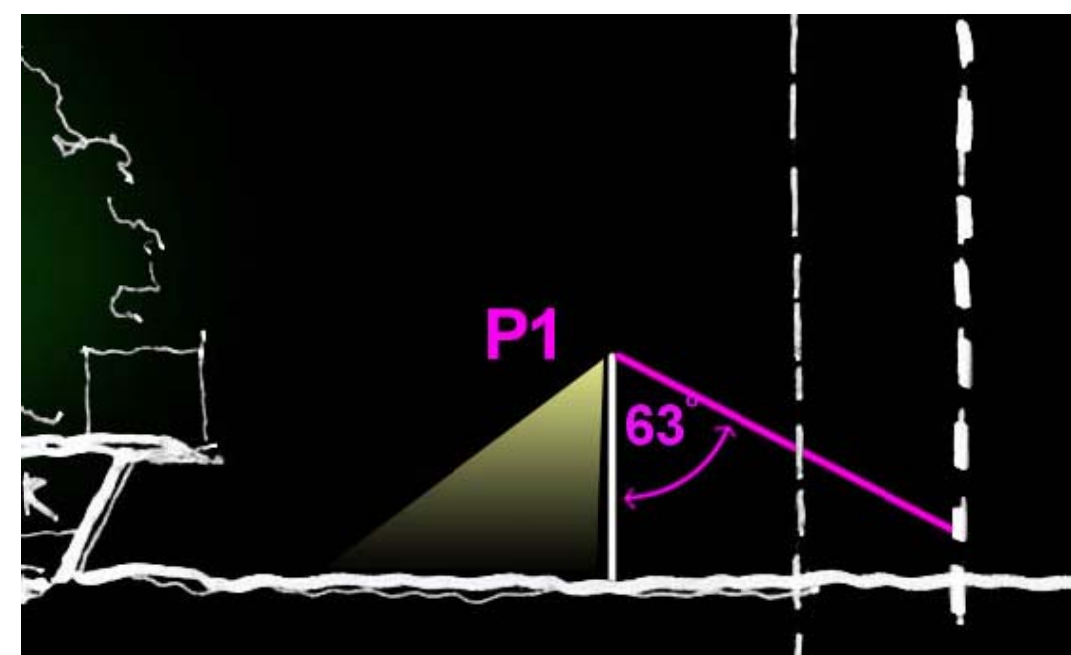
4.4 Luminaire Intensity Investigation

Based on the above design the luminous intensity or maximum visible brightness of the luminaires has been interrogated. The viewing angle is based upon the sectional information provided for the 66a Doncaster Road and is 5m approx from the Spectator Precinct property boundary.

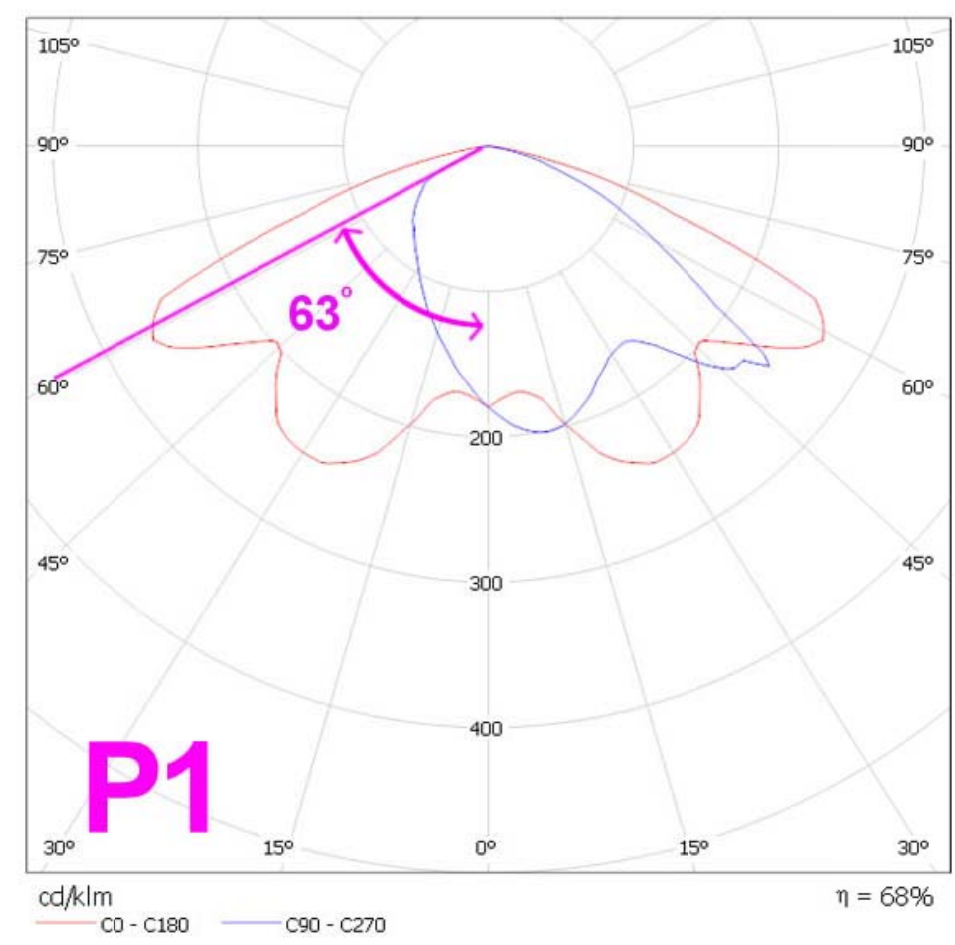


From this section the viewing angle from Doncaster Avenue to the luminaires has been identified.

For both pole locations a worst case viewing angle of 63° above vertical is shown.



To demonstrate compliance with the standard this viewing angle is then applied to the luminous intensity polar diagram for the luminaire.



This shows that when using this luminaire no light is directed above 90°. Therefore at a viewing angle of 63° a value of 315 cd is shown.

The maximum permissible value is 1000 cd. This analysis demonstrates compliance with AS4282

4.5 Threshold Increment

As the poles are not clearly visible from Doncaster Avenue the brightness produced will not have an impact on motorists and as such the scheme is compliant with the threshold increment limit.

4.6 Assessment Summary

| TechnicalParameter | Maximum Permissible Value | Calculated value | Compliant |
|---------------------|--|------------------|-----------|
| Light Tresspass | 10 lux | 3.18 lux | √ |
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| Threshold Increment | Luminaires have minimum viewing angles from Alison Rd and Doncaster Avenue and therefore do not impact them. | | √ |

Randwick Racecourse Lighting Masterplan Concept

